

What Is Claimed Is:

1 1. An apparatus for routing data between integrated circuit devices,
2 comprising:
3 an n-dimensional grid of integrated circuit devices;
4 a plurality of communication networks coupling the n-dimensional grid of
5 integrated circuit devices, wherein a communication network of the plurality of
6 communication networks moves data in only orthogonal dimensions; and
7 a routing mechanism configured to route data across the plurality of
8 communication networks as well as into, out of, and through a given integrated
9 circuit within the n-dimensional grid of integrated circuits;
10 whereby a process of routing signals across a given network is greatly
11 simplified because it is not possible to create a cycle that causes a deadlock within
12 the given network; and
13 whereby the process of routing signals yields a shortest path between
14 source and destination.

1 2. The apparatus of claim 1, wherein the n-dimensional grid of
2 integrated circuit devices includes memory devices.

1 3. The apparatus of claim 1, wherein the n-dimensional grid of
2 integrated circuit devices includes processor devices, I/O devices, digital signal
3 processors, field programmable gate arrays, sensors, and controllers.

1 4. The apparatus of claim 1, wherein the plurality of communication
2 networks for a two-dimensional grid includes:
3 a first communication network configured to move signals East and North;

4 a second communication network configured to move signals North and
5 West;
6 a third communication network configured to move signals West and
7 South;
8 and
9 a fourth communication network configured to move signals South and
10 East.

1 5. The apparatus of claim 1, wherein the routing mechanism is
2 configured to statically route data items across the plurality of communication
3 networks.

1 6. The apparatus of claim 1, wherein the routing mechanism is
2 configured to dynamically route data items through network junctions within each
3 integrated circuit.

1 7. The apparatus of claim 1,
2 wherein a header attached to each data item in a two-dimensional grid
3 indicates a number of horizontal steps and a number of vertical steps required for
4 the data item to reach its destination; and
5 wherein during a dynamic routing process, the routing mechanism
6 removes a horizontal step or a vertical step from the header for the data item,
7 depending upon which direction is dynamically selected.

1 8. A method for creating a computing system, comprising:
2 creating an n-dimensional grid of integrated circuit devices;

3 establishing a plurality of communication networks coupling the n-
4 dimensional grid of integrated circuit devices, wherein a communication network
5 of the plurality of communication networks moves data in only orthogonal
6 dimensions; and
7 providing a routing mechanism configured to route data across the
8 plurality of communication networks as well as into, out of, and through a given
9 integrated circuit within the n-dimensional grid of integrated circuits;
10 whereby a process of routing signals across a given network is greatly
11 simplified because it is not possible to create a cycle that causes a deadlock within
12 the given network; and
13 whereby the process of routing signals yields a shortest path between
14 source and destination.

1 9. The method of claim 8, wherein the n-dimensional grid of
2 integrated circuit devices includes memory devices.

1 10. The method of claim 8, wherein the n-dimensional grid of
2 integrated circuit devices includes processor devices, I/O devices, digital signal
3 processors, field programmable gate arrays, sensors, and controllers.

1 11. The method of claim 8, wherein the plurality of communication
2 networks for a two-dimensional grid includes:
3 a first communication network configured to move signals East and North;
4 a second communication network configured to move signals North and
5 West;
6 a third communication network configured to move signals West and
7 South;

8 and
9 a fourth communication network configured to move signals South and
10 East.

1 12. The method of claim 8, wherein the routing mechanism is
2 configured to statically route data items across the plurality of communication
3 networks.

1 13. The method of claim 8, wherein the routing mechanism is
2 configured to dynamically route data items through network junctions within each
3 integrated circuit.

1 14. The method of claim 8,
2 wherein a header attached to each data item in a two-dimensional grid
3 indicates a number of horizontal steps and a number of vertical steps required for
4 the data item to reach its destination; and
5 wherein during a dynamic routing process, the routing mechanism
6 removes a horizontal step or a vertical step from the header for the data item,
7 depending upon which direction is dynamically selected.

1 15. A means for routing data between integrated circuit devices within
2 an n-dimensional grid of integrated circuit devices, comprising:
3 a communication means comprising a plurality of communication
4 networks coupling the n-dimensional grid of integrated circuit devices, wherein a
5 communication network of the plurality of communication networks moves data
6 in only orthogonal dimensions; and

7 a routing means for routing data across the plurality of communication
8 networks as well as into, out of, and through a given integrated circuit within the
9 n-dimensional grid of integrated circuits;
10 whereby the means of routing signals yields a shortest path between source
11 and destination.

1 16. The means of claim 15, wherein the n-dimensional grid of
2 integrated circuit devices includes memory devices.

1 17. The means of claim 15, wherein the n-dimensional grid of
2 integrated circuit devices includes processor devices, I/O devices, digital signal
3 processors, field programmable gate arrays, sensors, and controllers.

1 18. The means of claim 15, wherein the plurality of communication
2 networks for a two-dimensional grid includes:
3 a first communication network configured to move signals East and North;
4 a second communication network configured to move signals North and
5 West;
6 a third communication network configured to move signals West and
7 South;
8 and
9 a fourth communication network configured to move signals South and
10 East.

1 19. The means of claim 15, wherein data is configured to statically
2 routed across the plurality of communication networks.

1 20. The means of claim 15, wherein data is dynamically routed through
2 network junctions within each integrated circuit.

1 21. The means of claim 15,
2 wherein a header attached to each data item in a two-dimensional grid
3 indicates a number of horizontal steps and a number of vertical steps required for
4 the data item to reach its destination; and
5 wherein during a dynamic routing process, a horizontal step or a vertical
6 step is removed from the header for the data item, depending upon which
7 direction is dynamically selected.